

# MULGA. A REVISION OF THE MAJOR SPECIES

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## Abstract

A review is given of morphology, reproduction, ecology and distribution in taxa of mulga. After an acknowledgement of the need for further study, a new classification of *Acacia* Mill. sect. *Juliflorae* (Benth.)Maiden & Betche is proposed. *Acacia minyura* and *A. paraneura* are described, as well as the two varieties, *A. aneura* F. Muell. ex Benth. var. *macrocarpa*, and *A. aneura* var. *conifera*. A new combination of *A. ayersiana* Maconochie var. *latifolia* (J.Black)Randell is made.

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## Introduction

This study was carried out to prepare a treatment for publication in the Flora of Australia. The project comprised the group of species popularly called 'mulga', and belonging to *Acacia* Mill. sect. *Juliflorae* (Benth.)Maiden & Betche (phyllodes many-nerved, spikes cylindrical). The species also share the following group of characters:

Sepals linear-spathulate, almost completely free; seeds relatively large, 4-6 mm long or longer; funicles short, scarcely arillate; pods 5-40 mm wide, chartaceous to coriaceous-crustaceous, conspicuously nerved; tall shrubs or small trees of the arid zone. Each character alone occurs in many other species, it is their combination which is useful in defining the group.

The species listed for the project were *A. aneura*, *A. brachystachya*, *A. craspedocarpa*, *A. ramulosa*, and *A. linophylla*. Other taxa sometimes considered as *mulga* (*A. ayersiana*, *A. catenulata*, and *A. subtessarogona*) were not included, but early in the study it was found imperative to add *A. ayersiana*, as this is very closely related to forms previously included in *A. aneura*. *A. subtessarogona* and *A. catenulata* were not studied.

### Materials and methods

Funding for this project was strictly limited, as was the time allocation of 6 months. There was thus no possibility of organising field work, and the study has been based entirely on observations of specimens in most of the principal herbaria in Australia (AD, BRI, DNA, NSW, PERTH and MEL).

Herbarium studies have been restricted to the recognition of taxa differing in gross morphology, assembling descriptions of these taxa, mapping their distribution, and determining the allocation of the various type specimens selected in the past. Due to the frequent occurrence of individuals of intermediate morphology, many of the taxa have been treated at the intraspecific level. To conform with earlier studies in the group, I have used the variety level. I have then arranged the taxa into groups (species) which I believe reflect their genetic affinities.

The distributions of herbarium specimens in the various taxa were mapped onto a grid of 1° latitude by 1.5° longitude, as has been done for other species of *Acacia* (Maslin and Pedley 1982). Any occurrence of a taxon within a particular cell of the grid was recorded. This grid pattern was then transferred to maps suitable for publication in the Flora of Australia.

The exclusion of field observations from the study must make the results incomplete, in particular due to the reported occurrence of hybrid individuals in many parts of Australia. Also, there have been frequent reports of populations consisting of several different morphological types (e.g. Lamont and Fox 1981, Cody 1989, 1991). However, these reports do not make it clear whether such populations consist of associations of individuals of several taxa, all mutually intersterile; associations of two or more interbreeding taxa and their sterile F1 hybrid offspring (as usually occurs in e.g. *Eucalyptus*); or two or more interbreeding taxa and their fertile F1 and backcross hybrids (as in *Senna*, Randell 1989). In the absence of this information, I have prepared this revision of the group as if all variants occur naturally within taxa, and do not result from hybridization between taxa. Field studies are urgently needed to clarify the nature of these non-uniform populations.

### Morphological characters

#### 1. Phyllodes

In this group of species phyllodes show great variation, from terete to falcate to oblong, from 1 to 20 cm long, and from 0.5 to 18 mm broad. However, two groups of taxa can be recognised, those whose phyllodes are usually narrow linear (or rarely terete) and less than 3 mm wide; and those whose phyllodes are falcate to oblong, and from 4 to 18 mm wide. The narrow phyllodes are from 3 to 20 cm long, the broader types from 1 to 12 cm long.

All phyllodes have many longitudinal veins, usually only visible with the use of magnification. (Phyllodes of seedlings and coppice growth of broad phyllode forms may have 3-7 of these veins stronger than the remainder, as noted by Everist 1949). However, in *A. craspedocarpa* the venation pattern becomes clearly reticulate with vein islets little more

than 1 mm in diameter. This is a pattern which recurs in other species outside this group (e.g. *A. verricula* Cowan & Maslin).

Phyllode anatomy of *A. ramulosa* is of the type illustrated by Boughton (1986) as "interrupted", with fibre caps of the veins extending to the sclerified epidermis, thus forming ridges. The terete or narrow linear phyllodes are deeply grooved between the ridges. T-shaped hairs are dense in these grooves, with stomates at the bottom adjacent to the photosynthetic tissue, while the intervening ridges are completely exposed at maturity.

In the remaining taxa, hairs are more regularly distributed, and are appressed to cover the entire surface at maturity. In addition, a layer of clear or opaque resin may develop which covers both the surface and the hairs growing from it.

## 2. Trichomes

Boughton (1989) described the trichomes on a range of Australian species of *Acacia*, including a specimen referred to *A. aneura* (listings of vouchers were available as an accessory publication to Boughton 1981, but this has not been seen). For this plant, she recorded the presence of two hair types, a T-shaped unicellular non-glandular non-coloured hair, and a club-shaped multicellular glandular coloured hair.

Present study has shown that clear hairs are very widely distributed over stems, phyllodes, peduncles and pods, though often they are later obscured by resin deposits. Those hairs examined in detail are T-shaped, though with shorter arms than indicated by Boughton. In addition, reddish club-shaped glandular hairs are very densely distributed over young organs (of all taxa except *A. ramulosa*), so that the whole growing point appears blackish. As the organs expand, these coloured hairs become more widely dispersed, though they persist on the margins of partly-expanded phyllodes, stems behind the growing point, and particularly on peduncles and young fruits.

The absence of these club-shaped glandular hairs is diagnostic for *A. ramulosa*. Examination reveals that in this species the growing points and young phyllodes of dried specimens are also blackish, but the colour is contained within cells of the epidermis, and all the trichomes are colourless. Peduncles and young fruits in this species also carry only non-glandular hairs. However, coloured deposits are developed within the mesocarp fibres of the fruits of *A. ramulosa*.

The epicarp of fruits of *A. ramulosa* remains densely white-hairy at maturity, while fruits of other taxa often retain a few coloured hairs late in their development, though all the hairs on these fruits may be enveloped within a dense layer of clear or opaque resin.

## 3. Inflorescences

In all the taxa of this group, flowers are carried in pedunculate spikes. These develop singly (rarely in panicles in *A. paraneura*) in the axils. Peduncles are 0.5-1.5 cm long, spikes are 0.5-3.5 cm long. Peduncles always carry simple hairs, and glandular hairs are present in all taxa except *A. ramulosa*.

## 4. Flowers

Flowers within the group appear relatively uniform. In general they are 5-merous, the sepals are free or almost free and alternate with the fused petals. There are many stamens, with dorsifixed anthers on long free filaments exceeding the petals. The single superior carpel has several ovules on a single marginal placenta. The outside of the ovary has simple clear hairs, and sometimes additional coloured hairs.



However, it has been suggested (Pedley 1973 and pers. comm.) that there are differences in both the shape of individual sepals and the degree to which these are fused, and that the differences may be of taxonomic importance.

Despite the stringent time limits imposed on the completion of this project, it was possible to examine the flowers of about 40 dried specimens, in the terete-podded (*A. ramulosa*), flat-podded (*A. aneura* var. *aneura*), and oval-podded (*A. cibaria*) taxa. (Voucher specimens are held in AD).

In all the 6 plants of *A. ramulosa* examined, the sepals were c. 1 mm long, and were fused below into a tube c. 0.2 mm long. The lobes of the calyx were spatulate with a fringe of clear hairs.

Fifteen flat-podded plants (*A. aneura* var. *aneura*) were examined. In 3 individuals, the sepals were clearly fused into a tube 0.1-0.3 mm long, in 6 the sepals were free to the base, and in 6 may have been very shortly fused. The lobes varied in shape from linear to spatulate, usually with many clear and some coloured hairs, and with total length varying between 0.5 and 1 mm long.

Twenty individuals with oval-section pods (*A. cibaria*) were examined. In 5, the sepals were clearly fused below into a tube to 0.3 mm long, in 6 they were clearly free to the base, while in the remaining 9 any fusion was too short to be clearly visible. As in the group above, the lobe shape varied from linear to spatulate, with both clear and coloured hairs, and lobe length reached 0.5-1 mm long.

Thus, the suggestion that sepal fusion can be used to distinguish the flat-podded forms from the oval-podded forms has not been supported. Further studies are needed to confirm this decision.

## 5. Pods

### i. Structural types

Within the group of taxa, pods are of two structural types. In *A. ramulosa*, they are cylindrical from initiation and are usually elongate (6-12 cm long, though abnormal pods may be much shorter). In the remaining taxa, pods are flat from initiation, (though they may become oval in section due to later development of mesocarp fibres, see below), and are generally much shorter, with only rare plants having some pods exceeding 6 cm long.

All of the pod valves have reticulate venation, in some taxa with the transverse veins more conspicuous, in others with the longitudinal veins better developed. In addition, all of them have a vein which develops at or very near the margin (Everist 1949), and to which the funicle is attached. It is the vein supplying the placenta of the developing seed.

This vein is always absolutely marginal in the cylindrical pods of *A. ramulosa* and the oval-section pods of *A. cibaria*. However, its position varies quite markedly in flat pods. It may be absolutely marginal (sometimes forming a distinct raised rim) through less than 1 mm from the margin (thus marking off an area less than 1 mm wide) to almost 5 mm from the margin (in large fruits of *A. craspedocarpa*).

It is the area between the submarginal vein supplying the funicles, and the margin of the valve, which has been incorrectly termed the "wing". It is sometimes of a slightly different colour to the rest of the valve, especially internally, and this may be due to the different development of fibres in the mesocarp (see below). Despite the inappropriateness of the term, I have chosen to continue its use in the interests of stability.



## ii. Texture

Pods within the group vary in texture from chartaceous to fibrous crustaceous. This variation results from differences in the development of mesocarp tissue in the pod valve.

The mesocarp of *A. ramulosa*, composed mostly of non-glandular colourless fibres but with a few coloured fibres also present, begins to proliferate very early in the maturation of the valve, so that the pod is cylindrical throughout its development. Mesocarp development is very restricted immediately above the seed, but extensive between seeds. This means that the valve develops around the seed, which eventually occupies a hemispherical depression within the body of the valve. The mature pod is fibrous and coriaceous-crustaceous.

In the valves of oval-section pods of *A. cibaria*, there is extensive formation of mesocarp tissue, but only late in the maturation of the pod. The seed occupies a hemispherical depression in the valve, and the mature pod is fibrous and coriaceous-crustaceous.

In *A. craspedocarpa*, there is limited development of the mesocarp tissue, mainly within the area delimited by the submarginal veins, but the mature valves are crustaceous, and pods remain flat. Pods of *A. paraneura* are also of this type.

In *A. minura*, very little mesocarp tissue is developed, and the mature valves are thin and chartaceous. This type of flat chartaceous pod is also found in *A. aneura* (three varieties), and *A. ayersiana* (both varieties).

## 6. Seed arrangement

In most taxa, seeds are arranged within the pods almost transversely, but with some tendency towards being oblique. However, in both *A. ramulosa* and *A. cibaria* seeds are arranged longitudinally within the pod. It is only in these last two taxa that there is any extensive development of the mesocarp tissue, but it is not known whether the two situations are genetically or developmentally linked. Further work is needed to clarify this relationship.

## 7. Seed size

There is considerable variation in seed size within the group. Those taxa apparently closely related to *A. aneura* have the smallest seeds in the group (4-6 mm long), while the marginal *A. ramulosa* and *A. craspedocarpa* have the largest seeds (6-12 mm long). The larger-seeded forms are confined to areas of Western Australia and adjacent states, and presumably they are better adapted for survival in the harsh arid environments where mulga occurs.

The large-seeded forms are those which provide valuable food resources for Aboriginal people, and probably also for native animals.

## 8. Habit

Plants in this group are shrubs, tall shrubs or small trees. Various authors have discussed habit, sometimes linking it to environmental variables. Everist (1949) gave an extensive coverage of forms in Queensland, while Lamont and Fox (1981) and Cody (1989, 1991) attempted to analyse variation in smaller areas of Western Australia. Fox (1986) presented an overview of variation for the whole of Australia.

## Biology

Despite extensive investigation of the biology of many Australian species of *Acacia* (e.g. Knox et al. 1989, Vanstone and Paton 1988 and references therein), information on the species known as mulga is very limited.

### 1. Sexual reproduction

*Acacia ayersiana* var. *latifolia* (cultivated, Adelaide Botanic Garden) produces polyad pollen, the number of grains per polyad varying between 8 and 16. Not all the grains are well formed. Both diploid and tetraploid plants have been reported (but without voucher specimens, Pedley 1973), and this may be linked to pollen sterility. Further work is needed to clarify this.

Many arid-zone species of *Acacia* are insect pollinated (Keighery 1982), and this probably applies to mulga as well.

Mulga trees produce hermaphrodite flowers after every heavy fall of rain at any time of year (Preece 1970a), but rain is most frequent in spring and summer. However, not every flowering event is followed by reproduction. Mature pods are not produced unless flowering is initiated by summer rain, and this is followed by rain in the subsequent winter (Davies 1976, Crisp 1978). Thus pods usually mature in summer months. The infrequency of this combination of events is reflected in the collections in Australian herbaria, where almost half of the specimens are unpodded, which renders their identification very difficult. Collectors are urged to make every effort in the future to find even empty pod valves on or in the soil beneath trees, to increase the value of the specimens they collect.

Seeds of all members of the group have similar funicles, once or twice folded, small in size and white to pale yellow to orange in colour. They are thus of the type expected to be transported by ants (O'Dowd and Gill 1986). Seed germination is affected by factors such as temperature, light, and CO<sub>2</sub> (Preece 1970b). Survival of the seedling depends on protection from grazing especially from introduced animals (Burrows 1973) such as rabbits, and sheep. Rabbits in particular may be responsible for the failure of mulga to regenerate (Hall et al. 1964, Lange and Graham 1983, Crisp 1978).

### 2. Vegetative reproduction

Mulga plants do not produce vegetative shoots from subsurface laterals (Maconochie 1982). As adults, they have low survival after fire (Hodgkinson & Griffen 1982). Trees lopped for fodder do not survive unless several of the basal branches are undamaged (Everist 1949).

### 3. Ecology

Over the last 50 years, much ecological study has centred around mulga. This is a reflection of the extensive distributional range it occupies and of the importance of the group to the pastoral industry. However, caution should be used in interpreting ecological review papers such as those cited here. The incorrect usage of specific epithets in ecological work may be very misleading, e.g. the name *brachystachya* has never previously been subjected to critical taxonomic study but has been widely used in ecological work. Probably it has not always been used in the same sense. A re-evaluation of ecological concepts may be required following refining of taxonomic concepts in papers such as this.

Mulga associations with mulga as the dominant or co-dominant species occupy  $1.5 \times 10^6$  square kilometres or about 20% of the Australian continent (between 115-151°E and 20-35°E), and are generally described as forming shrublands and open shrublands, or woodlands on more favourable sites (Johnson & Burrows 1981).

The soils on which mulgas occur are red earths, sands, loams and hardpans, apparently of low to moderate waterholding capacity, with little organic matter and low nutrient levels (especially so for phosphorous). Mulgas tend to be absent from very sandy and most clay soils (Walker and Fogarty 1986). As the accompanying distribution maps indicate, they are rarely recorded for the Simpson Desert of Northern Territory and South Australia, the Channel country of western Queensland, the Nullarbor Plain of Western Australia and South Australia, the Great Sandy and Gibson Deserts of Western Australia, and are only scattered within the Victoria Desert of Western and South Australia.

Mulga is predominantly found in areas receiving from 200 to 500 mm mean annual rainfall, but is conspicuously absent from the semi-arid regions with regular summer or winter drought (Nix & Austin 1973).

Mulga exhibits a number of adaptations to aid water uptake and retention and to minimise heat absorption. These include the spatial patterning of populations, where mulga occurring in groves receives run-off rainfall from sparsely-vegetated intergrove areas; growth on plains and sand plains which often receive some run-on water from adjacent hills and low ranges; the capacity to channel rainwater down the phyllodes to the stems so that rainfall is concentrated at the base of the trunk; the hairy, scurfy or resinous covering of the phyllodes; and dormancy during drought, from which the plant revives within 4 days of water becoming available (Johnson & Burrows 1981).

### Distribution patterns

Four taxa have very wide distributions.

*A. ramulosa* is less closely involved in the complex than are most of the other taxa, differing in the absence of glandular hairs, and in pod structure. It occurs across Australia through 114-147°E and 20-34°S. with many collections in western areas of Western Australia and most of South Australia, and fewer collections in eastern Western Australia, Northern Territory, Queensland and New South Wales. This may suggest an origin in the Pilbara region of Western Australia with dispersal in an easterly direction.

*A. cibaria* shows a pattern similar to that of *A. ramulosa*, though there are many fewer collections in this species. Its distribution extends through 114-148°E and 21-35°S, but generally with more scattered collections than those seen in *A. ramulosa*. Apparently it is never common.

*A. aneura* var. *aneura* is very widespread, extending through 115-148°E and 18-35°S. It is apparently common in all areas where it occurs.

*A. ayersiana* var. *latifolia* has a distribution even wider than that of *A. aneura* var. *aneura*, extending through 114-151°E and 21-34°S. It is probably best developed in eastern Australia, where it is the most common taxon encountered, but is less frequently encountered in Western Australia, thus hinting at a possible origin in the east of Australia.

Six taxa have more restricted distributions.

*A. ayersiana* var. *ayersiana* is restricted to southern Northern Territory (S of 22°S), most



of South Australia and far eastern areas of Western Australia. It probably evolved somewhere in this area. Another broad-phyllode taxon, *A. minyura*, has a similar distribution pattern to *A. ayersiana* var. *ayersiana*, (but extended towards the west coast), and also is likely to have evolved within this distribution area.

*A. craspedocarpa* is a taxon not central to the problem. It has distinctive reticulate venation of the phyllodes, crustaceous pods and large seeds. It is found only in Western Australia, in areas immediately south of the Pilbara, where it probably originated.

*A. paraneura* and *A. aneura* var. *conifera* have scattered occurrence across similar areas of Western Australia, Northern Territory and northern South Australia, between 114-136°E and 18-30°S. *A. aneura* var. *macrocarpa* is now very restricted and is found in only a few localities in central Western Australia. The distributions of these three taxa may be remnants of once more-extensive patterns.

In summary, the distribution patterns of most of the taxa in this group suggest evolution of the individual taxa in or near central arid regions of Western Australia, with some taxa never extending their distribution ranges from that area, but others becoming very widespread over inland areas of the continent. It is possible that one taxon may be of eastern origin.

### Taxonomic concepts

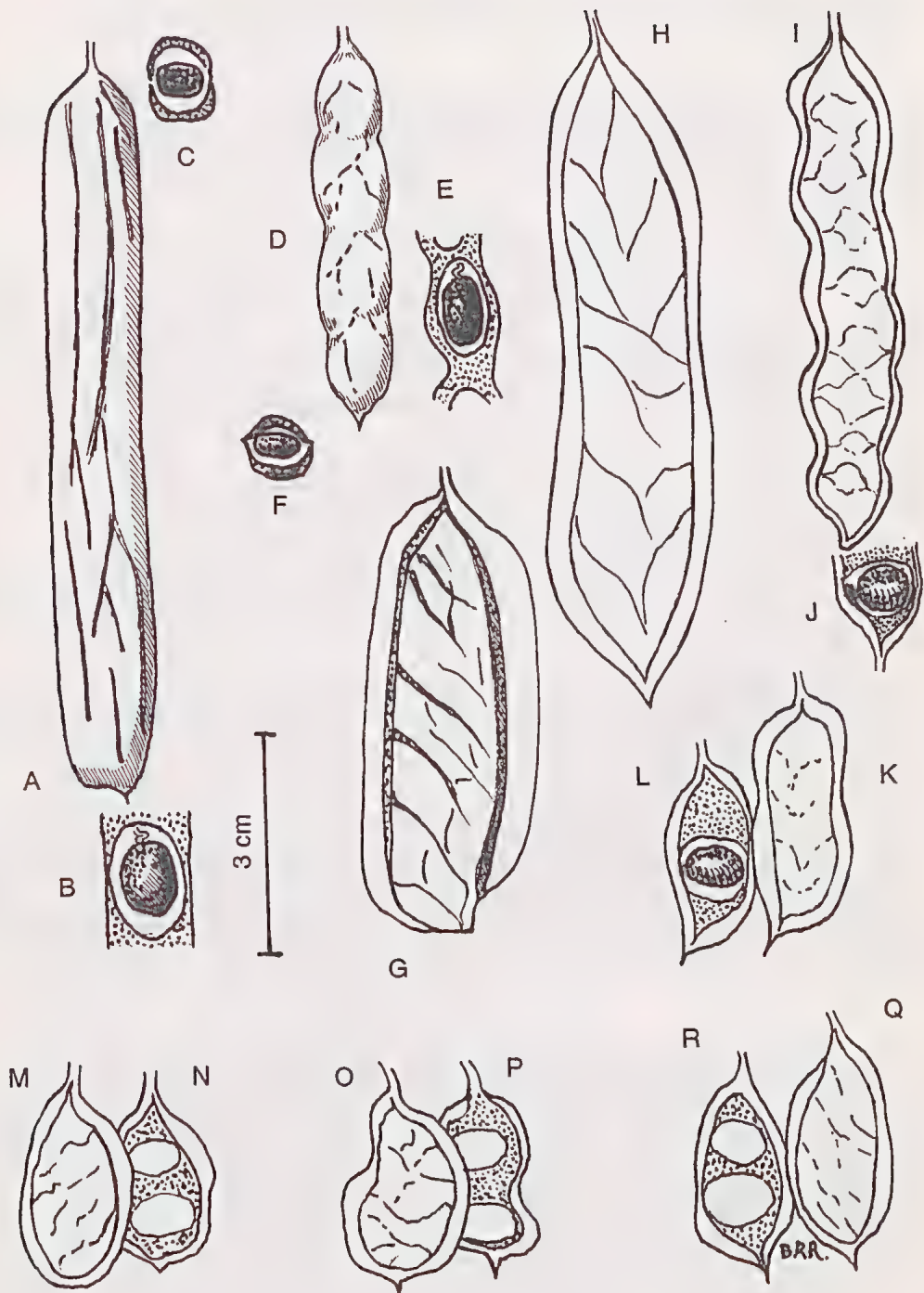
#### 1. Previous attempts at taxon recognition

Several tentative attempts have been made to recognise taxa within the broad range of plants grouped within mulga (e.g. Everist 1949, Pedley 1973, Maslin 1980). These usually looked at characters such as habit, phyllode structure, and pod structure including wing width.

It is my observation that the width of the pod wing is not a good taxonomic character, as it is not a distinct structure in itself, but merely an area not clearly demarcated within an organ (the pod valve). In addition, it may vary at different parts of a single pod, and in different pods on the one plant. On the other hand, pod structure and texture do seem to be reliable.

I have therefore used a combination of phyllode and pod structure to define taxa, but accept considerable variation in pod wing width in many of the taxa recognised here. This taxonomy works reliably on herbarium specimens, but will probably be improved by the addition of field characters in the future.

Fig. 1. Fruits and seeds. A-C, *A. ramulosa* W. Fitzg. (C.A. Gardner 6016, PERTH). A, outer surface of valve; B, inner surface of valve showing longitudinal arrangement of seed; C, section through entire pod, showing cylindrical structure of pod. D-F, *A. cibaria* F. Muell. (R.G. Andrewartha s.n., 17.x.1937, AD). D, outer surface of valve; E, inner surface of valve showing longitudinal arrangement of seed; F, section through pod showing flattened structure of pod. G, *A. craspedocarpa* F. Muell. (H. DeMarz 5672, PERTH). G, outer surface of valve. H, *A. paraneura* Randell (B.R. Maslin 5627, PERTH). H, outer surface of valve. I-L, *A. aneura* F. Muell. ex Benth. I-J, - var. *aneura* (L.D. Williams 7450, AD). I, outer surface of valve; J, inner surface of valve showing transverse arrangement of seed. K-L, - var. *macrocarpa* Randell (B.R. Maslin 2084, PERTH). K, outer surface of valve; L, inner surface of valve showing transverse arrangement of seed. M-P, *A. ayersiana* Maconochie, M-N, - var. *ayersiana* (A.A. Munir 5148, AD). M, outer surface of valve; N, inner surface of valve showing transverse arrangement of seed. O-P, - var. *latifolia* (J. Black) Randell (Morris 7596, AD). O, outer surface of valve; P, inner surface of valve showing transverse arrangement of seed. Q-R, *A. minyura* Randell (S. Midgley 525, PERTH). Q, outer surface of valve; R, inner surface of valve showing transverse arrangement of seed.



## 2. Discussion of 'habit taxa'

Specific epithets can be determined only by the linking of taxon descriptions, type specimens, protologues, and epithets. This paper links all four elements to produce a formal taxonomic treatment.

In the past, the lack of a detailed understanding of the morphological variation and taxonomy of the group has made it difficult to identify many of the variants met with in the field. In the absence of pods, some workers have been forced to determine taxa by differences in habit. However, such taxa cannot necessarily be linked with the taxa recognised here.

While these workers are recognising real variation in the field, it is now known that shrub or tree habit in mulga may be directly influenced by the environment in which it is occurring e.g. "a tree 10-15 m tall in the mesic areas, but only exists as a stunted low shrub 2-3 m tall in very xeric habitats or where it occurs on very shallow or calcarous soils" (Johnson and Burrows 1981). Also, shrubby and poorly productive ("hard") mulga can be induced to continue growth to form trees with heavier foliage crops ("soft mulga") by management practices such as scarifying the soil to improve water uptake (Batianoff, pers. comm.).

In addition, with the exception of *A. paraneura* and *A. aneura* var. *conifera*, herbarium records have not permitted me to link habit variation with individual taxa.

If it is necessary to recognise "habit forms" for whatever reason (e.g. if no pods are available to separate the narrow-linear phyllode taxa *A. aneura* vars. *aneura* and *macrocarpa*, and *A. cibaria*), I suggest that descriptive phrases be used, not the epithets of formal taxonomy.

However, I am sure that field study will bring to light other characters, probably including variation in habit, which can be used for field identifications of the formal taxa. Time constraints have prevented me from finding these characters. I hope that other workers will report them in the future.

## Revision

As a result of the examination of several thousand herbarium specimens, the following arrangement of taxa is proposed. Further study, including extensive field work and the elucidation of the biology of the group, especially with respect to hybridization, is clearly needed. This may lead to considerable modification of this taxonomy.

## Key to the species of mulga

1. Plants without reddish glandular hairs even on growing points; phyllodes deeply grooved, with non-glandular branched hairs densest in the grooves, the intervening ridges glabrescent and not covered by tips of hairs spreading from the grooves, without resin; mature pods cylindrical and densely white-hairy ..... 1. *A. ramulosa*
1. Plants with reddish glandular hairs especially dense on growing points, but still obvious on expanded organs especially peduncles and young stems; phyllodes not deeply grooved, non-glandular branched hairs persistent over surface, sometimes later enveloped in layers of opaque resin; mature pods usually flat, if not then moniliform, 4-angled, or oval in section, not densely white-hairy:
  2. Phyllodes terete to narrow linear, mostly 0.5-3 mm wide, sometimes a few on each plant wider reaching 5 mm:



3. Branches and phyllodes drooping; pods crustaceous and flat, with mainly longitudinal veins ..... 2. *A. paraneura*
3. Branches more or less erect or spreading or horizontal, phyllodes neither rigidly erect nor drooping; pods chartaceous and flat with transverse veins, or rarely fibrous and coriaceous-crustaceous, oval in section and with longitudinal veins:
  4. Mature pods chartaceous, flat, usually sparsely hairy between mainly transverse veins, though sometimes hairs enveloped in layers of opaque resin ..... 4. *A. aneura*
  4. Mature pods fibrous and coriaceous-crustaceous, oval in section, glabrescent between mainly longitudinal veins, not usually resinous ..... 3. *A. cibaria*
2. Phyllodes narrow linear, elliptic or falcate, mostly 5-20 mm wide, sometimes a few on each plant narrower (4 mm):
  5. Phyllodes of each plant mostly 5-12 cm long, rarely a few shorter:
    6. Phyllodes with dense reticulate veins; pods with crustaceous valves and raised reticulate veins ..... 7. *A. craspedocarpa*
    6. Phyllodes without reticulate veins; pods with chartaceous valves, and reticulate veins not raised:
      7. Shrubs or small trees to 3 m tall; phyllodes 1-2.5 cm long; plants with very dense opaque resin cover soon developing on phyllodes, stems, peduncles, and unexpanded spikes, but not covering persistent reddish stipules or mucros ..... 6. *A. minyura*
      7. Tall shrubs or trees 3-10 m tall; phyllodes 1.5-7 cm long; plants with resin cover thin or in flakes; stipules not conspicuous ..... 5b. *A. ayersiana* var. *latifolia*
  5. Phyllodes of each plant mostly 1-5 cm long, rarely a few longer:
    8. Pods flat ..... 5a. *A. ayersiana* var. *ayersiana*
    8. Pods 4-angled or moniliform ..... *A. subtessarogona*, *A. catenulata*

1. *A. ramulosa* W. Fitzg., *J. West Australian Nat. Hist. Soc.* 2(1):15 (1904).

*Lectotype*: Lennonville, ix.1903, *W.V. Fitzgerald s.n.* (PERTH, lecto. here chosen — a leafy twig with attached pod, and seed in a packet); *isolecto.*: (NSW! — a leafy twig with detached pods and no seeds, photo AD, PERTH).

As it is very probable that all the syntypes were available to the author, lectotypification seems necessary. The type collection is unlikely to have been broken up in the short period between the date of collection and the date of publication.

### Synonyms

1. *A. linophylla* W. Fitzg., *J. West Australian Nat. Hist. Soc.* 2(1):16 (1904).

*Lectotype*: Nannine, Cue, Mt Magnet, ix. 1903, *W.V. Fitzgerald s.n.* (PERTH, lecto. here chosen — a leafy twig with detached pod, an open valve and seeds in packet); *syntype*: (PERTH! — a leafy twig with closed pods and no seeds).

Lectotypification seems desirable as three localities (Cue, Nannine and Mt. Magnet) are given in the protologue.

2. *A. cibaria* F. Muell., *Australas. Chem. & Druggist, Suppl.* 5(51):26 (1882) p.p., as for several syntypes i.e. "near the Murchison R., Ch. Gray s.n." (MEL!); "near the Gascoyne R., Oliver Jones s.n." (MEL!); "fruits and seeds from Shark Bay, labelled Wonuy, sin. coll., s.d." (MEL!).

3. *Racosperma ramulosum* (W. Fitzg.) Pedley, *Austrobaileya* 2:354 (1987).

*Lectotype*: as for *A. ramulosa* W. Fitzg.

### Description

Shrub or small tree to 4 m, phyllodes erect; bark rough below, smooth and reddish above; growing points densely simple hairy over reddish epidermis, glandular hairs almost entirely absent. *Phyllodes* terete or narrow linear, 6-16 cm long, 1-3 mm wide, deeply grooved, with dense T-shaped hairs mostly confined to grooves, finally glabrous and naked on the ridges, rarely with surface resin deposits, usually olive green. *Inflorescence* oblong 7-23 mm long; peduncles 3-6 mm long, with only simple hairs. *Pod* pendulous, terete even when young, becoming thicker and coriaceous-crustaceous with early development of fibrous material in valve mesocarp except above seed, 20-180 mm long, 3-11 mm wide; when mature densely clear or white hairy between conspicuous dark longitudinal veins; seeds longitudinally arranged. *Seeds* 5-8 mm long, 3-6 mm wide, oval, dark glossy brown, areole area sunken; funicle subterminal, yellow. Bowgada (in Western Australia) or horse mulga (eastern States).

Illustrations: Fig. 1A-C; R. Erickson et al. (1982, p.146) as *A. linophylla*; G.M. Cunningham et al. (1981, p. 350); Whibley (1980, p. 209).

### Distribution and ecology

Found in all mainland states except Victoria, but more common in the western parts of the continent; usually growing in sand on or between ridges or in clay, rarely in laterite. Map 1.

### Notes

All individuals in this taxon are linked by the absence of glandular epidermal hairs, and the presence of terete crustaceous pods. There is variation in phyllode structure from narrow-linear (*A. ramulosa* W. Fitzg.) to terete (*A. linophylla* W. Fitzg.). However, I have not been able to recognise differences in the distribution patterns or ecological requirements of the two forms. For this reason, I consider the two names synonyms. As the narrow-linear forms are more common, I have retained the name *A. ramulosa* for the taxon. For further discussion of this problem, see Maslin (1980).

The funicle is attached at the peduncle end of the pod. The plants apparently crop more regularly, produce more pods per crop, and have more and larger seeds per pod than do other taxa in this group. The seeds are an important food source for Aborigines; names recorded are wonuy (W.A.), palpa (N.T.) and wintalyka (S.A.).

### Selected specimens (several hundred seen)

WESTERN AUSTRALIA: 16 miles [c. 40 km] NE Morawa, towards Yalgoo, *B.H. Smith* 498, 26.x.1984 (BRI, CANB, MEL, NSW, PERTH)

NORTHERN TERRITORY: Curtin Springs station, *P.K. Latz* 5687, 18.ix.1974 (BRI, DNA, PERTH).

SOUTH AUSTRALIA: c. 19 km W Termination Well, which is c. 40 km NW Leigh Ck, *T.R.N. Lothian* 3475, 14.xi.1964 (AD, CAL, CANB, SI).

QUEENSLAND: 49 km SE Adavale towards Charleville, *J.R. Maconochie* 2771, 5.vii.1981 (CANB, DNA, MEL, NSW, PERTH).

NEW SOUTH WALES: Mootwingee Ras, c. 110 km NE Broken Hill, *M. Fagg* 4, 13.v.1964 (AD).

### 2. *A. paraneura* Randell, sp. nov.

*A. aneurae* affinis sed ramulis et phyllodiis longioribus pendulisque, leguminibus longioribus rigidisque differt.

*Holotype*: 18 km from Wongawol homestead (which is c. 223 km. E Wiluna) towards Carnegie on the Gunbarrel hwy, *B.R. Maslin* 5627, 6.ix.1984 (PERTH); iso.: (BRI!, CBG, MEL!).

### Description

Shrub or small tree to 10 m tall; branches and phyllodes pendulous; bark grey, upper branches red and shining; stems silvery hairy, often very resinous; growing points hairy with simple and glandular hairs, these latter very dense on young parts but becoming dispersed as organs expand. *Phyllodes* terete, very long, 5-20 cm long, 0.8-1 mm wide, silvery hairy. *Inflorescence* oblong, 10-20 mm long; peduncle 5-8 mm long, with simple and glandular hairs. *Pod* flat, 15-90 mm long, 8-15 mm wide, rigid, crustaceous, silvery hairy between the (longitudinal) reticulate veins, resinous when mature, rich brown; wing 1.3-3 mm wide, obvious all round; seed arrangement transverse to oblique. *Seed* rather small, 4-6 mm long, 2-4 mm wide, oval, glossy, dark brown; areole flat; funicle with several folds, relatively large. Weeping mulga.

Illustrations: Fig. 1H; Midgley & Gunn (1985, fig 2d); Fox (1986, p. 31).

### Distribution and ecology

Dispersed over extensive areas of arid Western Australia and Northern Territory, usually growing on sandy flats or among rocks. Map 2.

### Notes

A very distinctive taxon, easily recognised by its long flexible phyllodes and its unique pods. The latter are obviously winged, flat and crustaceous (not chartaceous as are those of e.g. *A. aneura*), with reticulate veins predominantly longitudinal or V-shaped (see Fig. 1h).

Usually described as a graceful tree, perhaps with horticultural potential. The occurrence of non-weeping individuals with similar pods suggests that this taxon may intergrade with *A. aneura* var. *aneura*. The name reflects the affinity with that species.

### Selected specimens (about 50 seen)

WESTERN AUSTRALIA: Lake Cohen, 80 km N Gunbarrel hwy, *S.J. Midgley* 659, 10.xi.1983 (CANB, PERTH); 41.5 km from Wongawol homestead on Gunbarrel hwy to Carnegie homestead, *B.R. Maslin* 5629, 6.ix.1984 (CBG, PERTH).

NORTHERN TERRITORY: 10 miles [c. 16 km] E Coniston homestead, *G. Chippendale s.n.*, 11.viii.1959 (AD, DNA, NSW); c. 2 miles [c. 3 km] W Kurringa Bore, Mt Wedge, *A.O. Nicholls* 885, 2.vi.1968 (BRI, DNA, MEL, NSW).

3. *A. cibaria* F.Muell., *Australas. Chem. & Druggist* 5(51):26 (1882).

*Type citation*: "between the Darling R. and Barcoo, Dr Beckler ", not located.

*Lectotype*: Yuyinga Mts, Victorian Expedition, [Scrope Ra., c. 43 miles [c. 65 km] E Broken Hill, N.S.W., see Willis 1960], 6.xi.1860, *Dr Beckler s.n.* (MEL! lecto. here chosen — with pods, photos AD & PERTH); *isolecto.*: (NSW! — with pods); *syntypes*: [Scrope Ra., N.S.W.], 7.xi.1860, *Beckler* 2 (MEL! — without pods, photos AD & PERTH); [Scrope Ra.], 6.ix.1860, *Victorian Expedition s.n.* (MEL! — without pods, photos AD & PERTH); fragment of MEL, but not clear which sheet (PERTH! — without pods); [Scrope Ra.], -.xi.1860, *Victorian Expedition s.n.* (K, n.v., fide Pedley 1978).

### Lectotypification

In the protologue Mueller refers to at least 3 collections. These elements are not conspecific, as Mueller later recognised (cited in Tate 1882), and as noted by both Pedley



(1978) and Maslin (1980).

I agree with both Maslin and Pedley that one of these collections ("Murchison R., *C. Gray s.n.*", MEL!) is the same as that described by Fitzgerald in 1904 as *A. ramulosa*, and with Maslin that a second ("Gascoyne R., *O. Jones s.n.*", MEL! — pods and seeds only) could also be *A. ramulosa*.

If the name *cibaria* is lectotypified on either of these collections, then *A. ramulosa* will be reduced to synonymy. As *A. ramulosa* is very widespread, very common, and has not been confused in the past, this would be very undesirable.

The other collection cited in the protologue ("between the Darling R. and Barcoo, *Dr Beckler s.n.*") was that believed by Mueller (in Tate 1882) to represent *A. aneura* var. *stenocarpa* Benth. The locality for this was given by Bentham as "Barrier Ra., Victorian Expedition". The only material collected on this expedition and matching his description ("pods turgid, seeds longitudinal") was gathered by Dr Beckler between November 5 and 7, 1860. One of the listed syntype sheets ("7.xi.1860, *Beckler 2*", MEL!) has the locality citation "near the Barrier Ra.". At this date, Beckler recorded his position as Goginga Mountains, which was variously interpreted "Goginya, Goyinga, Gozinga, Guginga, Yayinga, Yayinya, Yuyinga, Yuyingee, Toguya etc of Mueller and Bentham" (Willis, 1960).

For this reason, sheets bearing any of the above locality citations (equated with Scrope Ra., N.S.W. by Willis in 1960), or collected between November 5th and 7th 1860, and with either Dr Beckler or Victorian Expedition as collector, may be considered syntypes.

Maiden (1917) explicitly equated this material with the name *A. brachystachya* Benth. (for a discussion on the application of this name, see below). Pedley (1978) chose this material as the lectotype of the name *A. cibaria*, because "Maiden implied that nomenclatural problems would be solved by selecting [it]".

However, in specifying that the lectotype for the name *A. cibaria* should be "Yayinya Mountains, Nov. 1860, *Beckler s.n.*; MEL" Pedley was also citing mixed material. There are 3 sheets in MEL fitting this description, and also others in NSW and K (as *A. aneura* var. *stenocarpa* Benth.), but Pedley did not specify or annotate a particular sheet or specimen. As the sheets are not identical, but have differing label details (e.g. for date in November, and Beckler's collection number), and not all have pods, his designation is not adequate to resolve the problem. This being so, I have taken the opportunity to refine his lectotypification on the only MEL sheet bearing pods, as these are essential in establishing the identity of *A. cibaria*.

## Synonyms

1. *A. aneura* var. *stenocarpa* Benth., *Fl. Austral.* 2:403 (1864).

Type citation: "Barrier Ra., *Victorian Expedition s.n.*"; not located.

Lectotype here chosen: as for *A. cibaria* in the sense adopted here (including the selected lectotype but excluding material treated under *A. ramulosa*). Full details of the reason for selecting the lectotype are discussed under *A. cibaria*.

[Pedley (1978) cites as holotype the collection in K, but all the MEL sheets are initialled as having been seen by Bentham, thus establishing them as syntypes. The NSW sheet may not have been seen by Bentham.]

2. *A. brachystachya* auct. non Benth.: Maiden (1917b), Pedley (1973). In this treatment, *A. brachystachya* Benth. has been excluded from consideration, for reasons discussed below.

*Description*

Bushy shrub or small tree to 6 m tall, phyllodes ascending; bark dark grey, finely fissured; growing points young stems and peduncles densely hairy with simple and glandular hairs, the latter very dense on young parts but becoming dispersed as organs expand. *Phyllodes* narrow-linear, rarely terete, ascending, not deeply grooved, 6-10(-15) cm long, 0.5-3 mm wide, grey-green, hairy with pale hairs densest over veins but spreading over whole surface; opaque resin often covering old phyllodes. *Inflorescence* oblong, 10-20 mm long; peduncle 4-12 mm long, with both simple and glandular hairs. *Pod* 15-75 mm long, 4-8 mm wide, quite flat when young, becoming turgid and crustaceous late in development [with the development of thick fibrous mesocarp within valves], not winged, densely hairy between veins when young but often glabrescent; reticulate veins clear, often slightly resinous, more obviously longitudinal than transverse; seed arrangement longitudinal. *Seeds* 5-8 mm long, 3-5 mm wide, oval, glossy golden brown, areole area sunken and paler; funicle subterminal and orange. Turpentine mulga.

Illustrations: Fig. 1D-F; Maiden (1917b, p.15); Whibley (1980, p.216).

*Distribution and ecology*

Found in all mainland states except Victoria, usually growing in red sand on dunes or swales, rarely in rocky streams. Map 3.

*Notes*

Though it is of wide distribution, it does not appear to be common in any locality. Frequently confused in the past with both *A. ramulosa* and *A. aneura* var. *aneura*. *A. ramulosa* does not have glandular epidermal hairs, and its mature pods are terete, not oval-sectioned as in *A. cibaria*. *A. aneura* has flat chartaceous pods, not coriaceous-crustaceous as in *A. cibaria*.

Reported as being unpalatable to stock.

*Selected specimens* (about 80 seen)

WESTERN AUSTRALIA: Glenorm station, *N.T. Burbidge* 286 & 288, viii.1938 (PERTH); Southern Murchison, *D.L. Anderson s.n.*, 26.x.1939 (AD); Giles, Rawlinson Ra., *J.B. Cleland s.n.*, 27.vi.1958 (AD); 8 km N Mt Magnet on Great Northern Hwy towards Meekatharra, *B.R. Maslin* 4509, 20.viii.1985 (PERTH); 3.5 km NNE Randall Well, Yarlalweelor station, *R.J. Cranfield* 5584, 10.viii.1986 (PERTH).

NORTHERN TERRITORY: 37 miles [c. 56 km] NE Lake Mackay, *G. Chippendale s.n.*, 16.vi.1957 (DNA); Reedy Rock Hole, George Gill Ra., *A.C. Beauglehole* 20478, 10.x.1966 (MEL); 6 miles [c. 9 km] S Alice Springs, *D.J. Nelson* 2265, 30.iii.1973 (DNA); 25 km NW Ayres Rock, *P.K. Latz* 5734, 21.ix.1974 (DNA); S Haasts Bluff, *P.K. Latz s.n.*, 8.xi.1976 (DNA).

SOUTH AUSTRALIA: Roopena homestead, c. 20 km NW Whyalla, *E.H. Ising s.n.*, 5.xi.1936 (AD); Termination Well, c. 60 km NW Leigh Creek, *T.R.N. Lothian* 3475, 14.xi.1964 (AD); c. 1 km NW Mt Gunson Copper Mine, *H. Eichler* 18883, 24.x.1966 (AD); 6 km SW Waukatanna waterhole, Coopers Ck., *F. Badman* 349, 6.xi.1981 (AD, BRI, MEL, NSW).

QUEENSLAND: Quilpie Common, *S.L. Everist* 5905, 10.xi.1957 (BRI; MEL); 3 miles [c. 5 km] W Windorah, *S.L. Everist* 7385, 1.viii.1963 (BRI, MEL); Quilpie, *L. Pedley* 2453, 11.ix.1967 (DNA).

NEW SOUTH WALES: Mundi Mundi, near Broken Hill, *E.F. Constable s.n.*, 23.xi.1947 (DNA); c. 25 miles [c. 40 km] SE Louth, *C.W.E. Moore* 4196, 25.ix.1966 (MEL); 19.2 miles [c. 32 km] from Engonnia towards Bourke, *M. Hall* H78/84, 19.ix.1978 (MEL); 4.5 km S Olive Downs homestead, NNW Tibboburra, *R.G. Coveny* 13449, 2.ix.1989 (AD, BRI, NSW).

#### 4. *A. aneura* F.Muell. ex Benth., *Linnaea* 26:627 (1855)

*Lectotype*: Cudnaka, [S.A.], *F. Mueller s.n.* (MEL! lecto. here chosen, — larger specimen with almost mature pods showing transverse seed arrangement, but without flowers); *syntypes*: Cudnaka, *F. Mueller s.n.* (MEL! — fragmentary, with 2 attached pods, photo AD, BRI, PERTH); fragment of MEL (PERTH!); 2 fragments from Sonder herbarium (MEL!).

Both MEL sheets were seen by Bentham, so lectotypification appeared necessary.

#### Synonym

*Racosperma aneurum* (F.Muell. ex Benth.) Pedley, *Austrobaileya* 2:344 (1987).

*Lectotype*: as above.

#### Description

Shrub or small tree to 5 m tall, branches  $\pm$  erect, spreading or horizontal; hairs dense on growing points mostly simple T-shaped but many reddish glandular, these last dense on growing points but becoming less dense as organs expand. *Phyllodes* terete to narrow linear, 2-11 cm long, 0.5-3 mm wide. *Inflorescences* oblong, 8-25 mm long; peduncles with both simple and glandular hairs, 3-9 mm long. *Pod* 10-100 mm long, 4-20 mm wide, chartaceous, veins reticulate usually mostly transverse; seed arrangement transverse slightly oblique. *Seeds* variable 4-9 mm long, 3-8 mm wide, glossy dark brown.

#### Distribution and ecology

The type variety is very widespread through all mainland states except Victoria, var. *conifera* is scattered through Western Australia, Northern Territory and South Australia, but var. *macrocarpa* occurs only in Western Australia.

#### Notes

All individuals in this species are linked by the possession of glandular epidermal hairs, and flat chartaceous pods with (usually) inconspicuous wings. By contrast, *A. ayersiana* and *A. minyura* both have wider phyllodes, and *A. cibaria* has coriaceous-crustaceous pods which are oval in section when mature.

#### Key to the varieties of *A. aneura*

1. Branches  $\pm$  erect, or spreading:
  2. Pods 10-50 mm long, often winged, golden brown.....4a. var. *aneura*
  2. Pods 20-100 mm long, not winged, often yellowish.....4b. var. *macrocarpa*
1. Branches horizontal.....4c. var. *conifera*

#### 4a. *A. aneura* var. *aneura*.

#### Description

Bark dark grey. *Phyllodes* 3-11 cm long, 0.7-3 mm wide (a few on each plant to 5 mm), terete to narrow linear (rarely almost elliptic), falcate, grey-green; old phyllodes not deeply grooved, hairs densest in shallow grooves but spreading to cover whole surface, finally more or less opaque resinous. *Pod* 10-50 mm long, 4-15 mm wide, chartaceous, often resinous, densely hairy between reticulate (predominantly transverse) veins, always flat, without fibrous buildup within valves, grey-green becoming gold brown at maturity;



wing 0.1 mm wide, variably obvious. *Seeds* relatively small, 4-6 mm long, 3-4 mm wide, oval, glossy deep brown; areole area flat, paler; funicle terminal, creamy. Typical mulga, narrow leaf mulga.

Illustrations: Fig. 1I,J; Whibley (1980, p. 214).

### *Distribution and ecology*

Very widespread through all mainland states except Victoria; grows in red sandy loam or gravel. Map 4.

### *Notes*

Typical mulga is recognised by the presence of glandular epidermal hairs, flat and chartaceous pods, and narrow phyllodes, most of which are less than 3 mm wide. In contrast, *A. ramulosa* lacks glandular hairs, *A. cibaria* has pods oval in section, both *A. ayersiana* and *A. minyura* have broader phyllodes, and *A. paraneura* has flat crustaceous pods.

Palatable to and heavily grazed by imported animals including rabbits, goats, sheep and cattle. An important fodder plant to the pastoral industry.

Intergrades with (perhaps because of hybridization) *A. ayersiana* vars. *ayersiana* and *latifolia*.

### *Selected specimens* (several hundred seen)

WESTERN AUSTRALIA: c. 40.2 km S Windy Corner, *A.M. Ashby 5422*, viii.1976 (AD, PERTH).

NORTHERN TERRITORY: c. 15 km N Andado homestead, Simpson Desert, *J.Z. Weber 966*, 11.vii.1968 (AD, DNA, HO, PERTH).

SOUTH AUSTRALIA: c. 6 km E Tallaringa Well, 140 km W Coober Pedy, *T.R.N. Lothian 2719*, 4.v.1964 (AD, MEL).

QUEENSLAND: near Buckingham Downs, c. 50 km S Dajarra, *L. Pedley 5296*, 9.x.1984 (BRI, MEL).

NEW SOUTH WALES: 11 miles [c. 18 km] N Broken Hill, *E.H. Ising s.n.*, 15.x.1921 (AD).

### 4b. *A. aneura* var. *macrocarpa* Randell, var. nov.

*A. aneurae* var. *aneurae* affinis sed leguminibus et seminibus grandioribus, leguminibus maturis luteolis differt.

*Holotype*: upper Rudall R. area, W.A., *B.R. Maslin 2084*, 3.ix.1971 (PERTH — leafy specimens with attached pods).

### *Description*

Bark grey finely fissured, smooth on branches. *Phyllodes* 4-10 cm long, 1-2 mm wide, terete or narrow linear; phyllodes and stems silvery hairy, later resinous. *Pod* 20-100 mm long, 7-20 mm wide, not usually winged, often with distinct rim or narrow edge, flat, chartaceous to coriaceous, sparsely hairy between mainly longitudinal reticulate veins, pruinose, sometimes raised over seeds, pale brown when immature, often almost yellow at maturity; seed arrangement almost transverse. *Seeds* 6-9 mm long, 4-8 mm wide, oval, dark

glossy brown, areole area flat, funicle terminal, long and folded. Yellow pod mulga; large-pod mulga.

Illustrations: Fig. 1K, L.

### *Distribution and ecology*

Occurs only in a few areas in central Western Australia, where it has been reported growing in red sand or loam, or rarely along stony watercourses. Map 5.

### *Notes*

The only apparent differences between this and var. *aneura* are the much larger seeds and the longer fruit of var. *macrocarpa*. Not identifiable without fruit. The name describes the conspicuously larger fruit.

There is also a group of specimens with larger crustaceous fruit whose veining pattern suggests derivation from *A. paraneura* e.g. *Maslin* 2183 (BRI, K, MEL, PERTH).

### *Specimens* (all those seen)

WESTERN AUSTRALIA: Mt Russel, W of Wiluna, *N.T. Burbidge* 4794, 11.xii.1955 (CANB, PERTH); Towera station, *J.S. Beard* 3619, 25.vii.1964 (PERTH); Ashburton Downs, *J.S. Beard* 6117, -.viii.1970 (PERTH); Rudall R., *M. McInnes* 13, 5.x.1971 (PERTH); upper Rudall R. area, *B.R. Maslin* 2182, 8.ix.1971 (BRI, DNA, PERTH); upper Rudall R. area, *B.R. Maslin* 2216, 9.ix.1971 (AD); upper Rudall R. area, *B.R. Maslin* 2292, 14.ix.1971 (DNA, PERTH); c. 11 km NW Newman towards Rhodes Ridge, *B.R. Maslin* 4589, 8.vii.1980 (PERTH); S end of Varoo station, *J. Stretch s.n.*, viii.1981 (PERTH); 8 km S Wiluna on road to Agnew, *B.R. Maslin* 5396, 19.ix.1983 (PERTH).

### 4c. *A. aneura* var. *conifera* Randell, var. nov.

*A. aneurae* var. *aneurae* affinis sed ramis horizontalibus, habitibus arborum coniferarum et plerumque phyllodiis brevioribus differt.

*Holotype*: c. 25 km NNW Yuendumu, N.T., 25.viii.1981, *P.K. Latz* 8804 (PERTH); iso.: (DNA!, CBG n.v.).

### *Description*

Branches horizontal, young growth very viscid; bark dark grey, rough or flakey. *Phyllodes* terete or narrow linear, rigid, 1.5-10 cm long, 0.5-2 mm wide; phyllodes and stems silvery hairy, soon resinous. *Pods* 15-25 mm long, 6-8 mm wide, chartaceous, rimmed but not winged, with sparse hairs, without resin; seed arrangement transverse; golden brown. *Seeds* small, 4-6 mm long, 3-4 mm wide, glossy brown, oval; areole flat, funicle almost terminal, pale. Christmas tree mulga, conifer mulga.

Illustrations: Boomsma and Lewis (*Bulletin* 25, p. 46).

### *Distribution and ecology*

Collected from Western Australia and Northern Territory, of very scattered distribution. Usually grows in sandy loam or on rocky ridges. Map 6.

### Notes

Herbarium specimens have only been assigned to this taxon when the label has contained reference to the coniferous habit. Most of the specimens have short terete phyllodes, more rigid than those of other varieties of *A. aneura*. The pods are flat and chartaceous, without wings, indicating a close relationship to *A. aneura*.

A conspicuous habit variant, perhaps worth recognising taxonomically. The name derives from the coniferous growth habit.

N.B. no authenticated material collected in S.A. has been seen, but the photograph listed above was taken in the far north west of South Australia.

### Selected specimens (about 80 seen)

WESTERN AUSTRALIA: 4 miles [c. 6.5 km] E Notabilis Hill, Gunbarrel hwy, Gibson Desert, *A.S. George 5376*, 25.vii.1963 (PERTH); 30 km ENE Gindalbie homestead, c. 57 km NNE Kalgoorlie, *P.G. Wilson 7524*, 31.viii.1968 (PERTH); upper Rudall R. area, *B.R. Maslin 2220*, 9.ix.1971 (DNA); Canning Stock Route, N Lake Disappointment, *B.R. Maslin 2273a*, 12.ix.1971 (MEL); 9 km W Laverton, c. 110 km NE Leonora, *S.J. Forbes s.n.*, 9.x.1983 (PERTH).

NORTHERN TERRITORY: 15 miles [c. 24 km] SE Anningie homestead, *G. Chippendale s.n.*, 29.vii.1958 (MEL, NSW); 7 miles [c. 11 km] W Alice Springs towards Hermannsburg, *D.J. Nelson 1603*, 15.xi.1967 (DNA); 5 km W Gahnda Rockhole, Gibson Desert, *A. Kalotas 1128*, 1.iv.1982 (DNA); Leaders Mine, Kurundi station, *P.K. Latz 9796*, 28.ix.1983 (DNA).

**5. *A. ayersiana* Maconochie, *J. Adelaide Bot. Gard.* 1(3): 182 (1978).**

*Holotype*: Ayres Rock, N.T., 19.x.1973, *J.R. Maconochie 1930* (NT, n.v., fide Maconochie, *J. Adelaide Bot. Gard.* 1(3): 182 (1978)); *iso.*: (AD!, BRI!, DNA!, NSW!, PERTH!).

### Description

Shrub or tree 2-10 m tall; bark dark grey, fissured; vegetative parts with simple and glandular hairs, these latter dense on growing points, becoming dispersed as organs expand. *Phyllodes* falcate to elliptic, 2-12 cm long, 4-12 mm wide, densely simple hairy, resinous. *Inflorescences* oblong, 8-30 mm long; peduncles simple and glandular hairy, 3-15 mm long. *Pod* 10-60 mm long, 5-25 mm wide, flat, chartaceous, transverse reticulate veined, sometimes resinous; seed arrangement transverse to oblique. *Seed* 3-8 mm long, 2-7 mm wide.

### Notes

Individuals are linked by the possession of glandular epidermal hairs, flat chartaceous pods (often with conspicuous wings) and elliptic to falcate phyllodes, mostly more than 5 mm wide. In *A. aneura*, the phyllodes are narrower, and in *A. minura*, the phyllodes are much shorter.

### Key to the varieties of *A. ayersiana*

1. Phyllodes 4-12 cm long, 4-12 mm wide; pod wing 1-2 mm wide.....5a. var. *ayersiana*
1. Phyllodes 1.5-7 cm long, 4-10 mm wide; pod wing 0-1 mm wide.....5b. var. *latifolia*



**5a. *A. ayersiana* var. *ayersiana****Description*

*Phyllodes* 4-12 cm long, 4-12(-18) mm wide, usually falcate rarely elliptic, densely hairy, grey green; opaque resin developing on phyllodes and stems. *Pod* 12-40 mm long, 8-17 mm wide, flat, chartaceous, sparsely hairy, not resinous, brown; wing 1-2 mm wide, conspicuous; seed arrangement transverse. *Seed* to 6 mm long, to 3 mm wide, oval, glossy, dark brown; funicle subterminal small yellow. Blue Mulga.

Illustrations: Fig. 1M, N; Maconochie, *J. Adelaide Bot. Gard.* 3: 181, Fig. 2 (1978).

*Distribution and ecology*

Occurs in eastern Western Australia, south of Northern Territory and western South Australia, usually in red sand or earth, with clay, sometimes in swales. Map 7.

*Notes*

This taxon is characterised by short pods with conspicuous wings, and long phyllodes. The common name derives from the bluish tinge given to the phyllodes by the resinous deposit covering them.

## Selected specimens (about 50 seen)

WESTERN AUSTRALIA: Coolgubbin, c. 16 km S Neales Junction, *B.C. Crisp* 27, 20.v.1974 (AD); Coolgubbin, c. 16 km S Neales Junction, *B.C. Crisp* 46, 21.v.1974 (AD); 110 km by road S Warburton towards Rawlinna, *B.R. Maslin* 5687, 10.ix.1984 (CBG, PERTH).

NORTHERN TERRITORY: Haarst Bluff station, *P.K. Latz* 7578, 14.x.1977 (DNA, PERTH); Ayres Rock camping ground, *J.R. Maconochie* 2536, 30.ix.1979 (AD, BRI, DNA, MEL, NSW); 19 miles W Curtin Springs, *M. Lazarides* 6177, 8.x.1986 (AD, CANB, DNA, NSW); Uluru National Park, *M. Lazarides* & *J. Palmer* 395, 12.viii.1988 (CANB, DNA, MEL, NSW).

SOUTH AUSTRALIA: c. 185 km W Mabel Ck homestead, *N.N. Donner* 3868, 16.vii.1972 (AD); 44 km N Twins homestead, L.Eyre basin, *J.D.E. Whibley* 6310, 24.viii.1978 (AD); Serpentine Lakes, near Vokes Corner, 7 km E WA-SA Border, *J.Z. Weber* 6467, 26.viii.1980 (AD, NSW).

**5b. *A. ayersiana* var. *latifolia* (J. Black)Randell, comb. nov.**

*Basionym*: *A. aneura* var. *latifolia* J. Black, *Trans. Roy. Soc. S. Australia* 47:370 (1923).

*Lectotype*: Cobar [N.S.W.], *L. Abrahams* 178, -.ix.1910 (AD, lecto. here chosen, — leafy specimen with flowers, and drawings by J.M. Black of dissected flowers); isolecto.: (NSW!); syntypes: Ooldea [S.A.], *J. Black s.n.*, 24.ix.1920 (AD!); Ooldea [S.A.], *J. Black s.n.*, 27.ix.1920 (AD!).

*Possible syntypes*: Cobar [N.S.W.], *L. Abrahams* 515, -.ix.1910 (AD!); Cobar [N.S.W.], *J.B. Cleland s.n.*, 14.ix.1911 (AD!); Ooldea [S.A.], *S.A. White s.n.*, -.xii.1917 (AD!); Ooldea [S.A.], *sin. coll.*, -.viii.1918 (AD!); Broken Hill [N.S.W.], *E.H. Ising s.n.*, 18.x.1921 (AD!); Ooldea [S.A.], *Mrs Bates s.n.*, 2.v.1921 (AD!).

*Description*

*Phyllodes* 1.5-7 cm long, 4-10 mm wide (sometimes a few narrower on the same plant),

falcate, sometimes elliptic; phyllodes and stems persistently simple hairy, with opaque resin soon developing, often pruinose. Seedling phyllodes broader, with 3 veins conspicuous. Mature phyllodes rarely with a few branching veins and thus forming some reticulations. Pods 10-60 mm long, 5-25 mm wide, chartaceous, sparsely hairy between the transverse reticulate veins, oblong, sometimes resinous, green-brown; wing 0.1 mm wide variable, rarely obvious. Seeds small, 3-8 mm long, 2-7 mm wide, oval, glossy dark brown; areole area flat, paler; funicle terminal flat creamy. Broad-leaf mulga, umbrella mulga.

Illustrations: Fig. 1O, P; G.M. Cunningham et al. (1981, pp. 346, 347) as *A. aneura* var. *latifolia*.

### *Distribution and ecology*

Found in all mainland states except Victoria. In Queensland and New South Wales this is the most common form encountered. It is often found in conjunction with other taxa of the group, growing in red sand or loam, rarely on rocky areas or watercourses. Map 8.

### *Notes*

The protologue contains no reference to specimens nor localities. The lectotype has been selected from material which was either collected by Black, or bears annotations showing it to have been seen before the date of publication of the name. The specimens cited as "possible syntypes" bear no evidence of having been seen before that date, though they may well have been available to the author.

A very variable taxon, defined chiefly by the structure of the phyllodes. These are shorter than those of var. *ayersiana*, longer than those of *A. minyura*, and broader than those of *A. aneura*. However, it intergrades with *A. ayersiana* var. *ayersiana*, and narrower phyllode forms may be derived from hybridization with *A. aneura* var. *aneura*. Maslin suggests (*pers. comm.*) that Western Australian individuals with branching veins in the phyllodes may be hybrids derived from *A. craspedocarpa*.

It is very palatable and in times of drought is lopped to provide fodder for sheep and cattle.

### *Selected specimens* (several hundred seen)

WESTERN AUSTRALIA: 5 miles [c. 8 km] W Meekatharra, *N.H. Speck* 559, 3.ix.1957 (CANB, MEL); 13.5 miles [c. 20 km] S Menzies towards Kalgoorlie, *B.R. Maslin* 1941, 11.viii.1971 (DNA); 11 km E Riverina homestead towards Menzies, *M.G. Corrick* 9123, 30.ix.1984 (MEL).

NORTHERN TERRITORY: 10 miles [c. 16 km] N Kulgera, *R.E. Winkworth* 126, 9.iii.1954 (CANB, MEL); Mulga Park homestead, c. 300 km SW Alice Springs, *P.G. Wilson* 2339, 30.vii.1962 (AD); Kathleen Spring, George Gill Ra., *A.C. Beauglehole* 20502, 10.x.1966 (DNA, MEL); c. 40 km WNW Alice Springs, *A.E. Orchard* 682, 5.vii.1968 (AD, DNA).

SOUTH AUSTRALIA: c. 100 km S Vokes Hill, c. 130 km N Cook, *T.R.N. Lothian* 5695, 20.vii.1972 (AD); 21 km W Mt Christy, Nullarbor Plain, *F.A. Mowling* 66, 27.ix.1976 (AD); 20.3 km from Balcanoona homestead, *L.D. Williams* 11704, 2.xi.1980 (AD); Mabel Creek, *M.F. Nobbs* 1262, 25.iv.1984 (AD); Balcanoona Ra., Gammon Ras Natl Park, *P.E. Conrick* 1734, 29.ix.1984 (AD, CANB).

QUEENSLAND: Boatman station, No 15 bore, *S.L. Everist* 3095, 18.vii.1947 (BRI, MEL); Hollymount Holdings, 34 miles [c. 55 km] W Westmar, Moonie hwy, *L. Pedley* 908, 19.xi.1961 (BRI, MEL); c. 16 miles [c. 25 km] NW Longreach, *S.L. Everist* 7295, 25.vii.1963 (BRI, MEL); c. 110 km SE Windorah towards Quilpie, *R.J. Henderson & D. Boyland* H2111, 16.ix.1973 (AD, BRI); Cooladdi, *D. Boyland* 8062, 9.x.1979 (DNA); 25 km W Bollon, *T. & J. Whaite* 3814, 25.viii.1981 (CBG, MEL, NSW).

NEW SOUTH WALES: 7 miles [c. 11 km] W Mazar station, near S.A. border, *E.F. Constable s.n.*, 24.vii.1955

NEW SOUTH WALES: 7 miles [c. 11 km] W Mazar station, near S.A. border, *E.F. Constable s.n.*, 24.vii.1955 (DNA); foothills Gunderbooka Ra., 56 km S Bourke, *E.F. Constable 4549*, 16.x.1963 (MEL, NSW); "Tundulya", c. 20 miles SE Louth, *C.W.E. Moore 3814*, 24.vii.1966 (CANB, MEL); Owens Gap, c. 9 miles [c. 14 km] W Scone, *C. Burgess s.n.*, 13.viii.1969 (CANB, MEL); Mootwingie Reserve, near camping area, *M.G. Corrick 5539*, 15.ix.1976 (MEL); 27.7 km from Bourke towards Nyngan, *N. Hall H78/88*, 21.ix.1978 (MEL).

## 6. *A. minyura* Randell, sp. nov.

*A. ayersianae* affinis sed phyllodiis brevioribus, ramulis phyllodiisque resinosissimus differt.

*Holotype*: 24 km E Ayres Rock, 30.ix.1979, *J.R. Maconochie 2539* (PERTH); *iso.*: (BRI!, DNA!, NSW!, B, CBG, G, HO, MO, PAUH, n.v.).

## Description

Multi-stemmed shrub or small tree to 3 m high; growing points with dense simple and glandular hairs, these becoming dispersed as organs expand; however, all parts including unopened buds (but excluding reddish stipules and phyllode mucros) soon enveloped in thick droplets or layers of opaque resin. *Phyllodes* 1-2.5 cm long, 2-10 mm wide, elliptic to falcate, mucronate, hairy, with dense resin, grey but pale blue at branch tips due to opaque resin. *Inflorescence* oblong 6-20 mm long; peduncles 2-9 mm long, with simple and glandular hairs. *Pod* flat, 10-30 mm long, 6-16 mm wide, chartaceous, sparsely hairy between reticulate veins, oblong, brown; wing 1-2 mm wide, well developed; seed arrangement transverse. *Seed* small, oval, 4-5 mm long, 2-3 mm wide, glossy, gold to dark brown; areole area paler, usually sunken; funicle terminal creamy, flat. Desert form. Variant A of Maslin (*Flora of Central Australia*).

Illustrations: Fig. 1Q, R.

## Distribution and ecology

Growing in red sand or earth, sometimes with laterite, from near the west coast in Western Australia, north and east to Alice Springs in Northern Territory and to 29°S in South Australia. Map 9.

## Notes

This taxon may be recognised by the short broad phyllodes with dense resin cover, and the flat chartaceous winged pods. An important source of resin for Aborigines, from one of whose names for the plant the specific epithet is taken (Kean 1991 and voucher specimens).

## Selected specimens (about 100 seen)

WESTERN AUSTRALIA: Barrow Ra., c. 120 km W of 3-state junction, *J.B. Cleland s.n.*, 25.vi.1958 (AD); Rawlinson Ra., S side below Circus Rock Holes, *J.M. Bechervaise & J. Kelso 128*, 11.v.1980 (MEL).

NORTHERN TERRITORY: Hamilton Downs station, *R.E. Winkworth 1354*, 21.ix.1955 (CANB, MEL); Victory Downs, c. 30 km SW Kulgera, *J.Z. Weber 116*, 27.x.1966 (AD); c. 11 km W Curtin Springs homestead, *N.N. Donner 4337*, 22.viii.1973 (AD, DNA); 21 km E Ayres Rock towards Curtin Springs, *B.G. Briggs 7161*, 30.ix.1979 (CBG, MEL, NSW).

SOUTH AUSTRALIA: Mt Moulden, far NW of S.A., *W.S. Reid 42*, 25.ix.1955 (AD); c. 100 miles [c. 160 km] S Mt Davies, Birksgate Ra., *J.B. Cleland s.n.*, 4.vii.1961 (AD); Emu-Dingo Claypan road, *W.S. Reid s.n.*, 5.vii.1967 (AD); 30 km SSE Fregon, *H. Haigh sub L.D. Williams 6532*, late Oct. 1974 (AD).



**7. *A. craspedocarpa* F.Muell., *Chemist & Druggist Australasia New Ser.* ii:73 (1887)**

*Lectotype*: Lake Austin [W.A.], *H.S. King s.n.* (NSW, lecto. here chosen, leafy specimen with attached pods); *islecto.*: (MEL! 2 sheets, one of leafy shoots, the other of detached pods); *syntype*: between Yuin and Murchison R., *E. Giles s.n.*; (MEL!).

[Mueller also mentions a collection by Mr Winnecke from 'near Stuarts Ra.'. This collection is in MEL!, and falls within *A. minyura* Randell.]

**Synonym**

*A. euphleba* W. Fitzg., *J. West Australian Nat. Hist. Soc.* 2(1):16 (1904).

*Lectotype*: near Millys Soak, near Cue, Murchison R. District, *W.V. Fitzgerald s.n.*, .ix.1903 (NSW!, lecto. here chosen—a more complete specimen); *islecto.*: (PERTH!).

Lectotypification seems desirable as both sheets were probably available to the author. The collection was unlikely to have been broken up in the short time before publication of the name.

**Description**

Rounded shrub or small tree to 8 m tall; bark grey fibrous; growing points covered with simple and glandular hairs, the latter very dense over young organs, becoming more dispersed as organs expand; phyllodes and stems finally with extensive opaque resin deposits. *Phyllodes* 1-5 cm long, 4-8 (-18 mm) wide, elliptic to obovate, sometimes falcate, with many conspicuous reticulate veins, densely white hairy, finally surface including hairs embedded in dense opaque resin; grey green. *Inflorescences* oblong, 8-22 mm long; peduncles 10-12 mm long, robust (1 mm diam.) with simple and glandular hairs. *Pod* 15-120 mm long, 8-40 mm wide; completely flat when young, at maturity crustaceous, slightly oval in section by the increased thickness of the valves, densely hairy with mixed simple and glandular hairs, except over raised conspicuous mostly transverse veins, whole surface finally with thick resinous cover; wing well developed 1-5 mm wide; seed arrangement transverse to slightly oblique. *Seeds* 7-12 mm long, 5-10 mm wide, thin, oval, glossy golden brown; areole area raised; funicle terminal. Camel bush, hop mulga or round-leaf mulga.

Illustrations: Fig. 1G; L.Diels & E.Pritzel (1904, p. 306).

**Distribution and ecology**

Grows only in arid areas of Western Australia, usually in red sand, clay, or loam or on rocky hillsides. Map 10.

**Notes**

The distinctive venation pattern of the phyllodes and the raised reticulate veins of the crustaceous pods make this taxon easily recognisable. Some of the seeds have an unusual flattened marginal rim 1 mm wide. Reported as a good fodder plant.

Topotype material of *A. euphleba* collected by Maiden (NSW, MEL) resembles *A. craspedocarpa* vegetatively with phyllodes only 3 cm long, but has massive pods 10-12 cm long and 2-4 cm wide, and seeds 10 mm long, 8 mm wide.

*Selected specimens (about 50 seen)*

WESTERN AUSTRALIA: 10 km NW Albion Downs homestead, R.J. Chinnock 972, 12.ix.1973 (AD, PERTH); 17 miles [c. 30 km] N Leonora, C.A. Gardner 7951, 18.x.1945 (MEL).

**Excluded name**

*Acacia brachystachya* Benth., *Fl. Austral.* 2:403 (1864); *A. aneura* var. *brachystachya* (Benth.)Maiden, *Wattles and Wattle-Barks* edn 3:61 (1906); *Racosperma brachystachyum* (Benth.)Pedley, *Austrobaileya* 2:345 (1987).

*Lectotype*: Mutanie Ras [Mootwingee, N.S.W., 3.i.1861, see Willis 1960], *Dr. Beckler s.n.* (MEL), lecto. here chosen, — a leafy specimen with very young flowers, and without fruit, initialled as having been seen by Bentham); *isolecto.*: (K, n.v., fide Pedley, *Austrobaileya* 1(2):131 (1978) — without fruit, fide Bentham 1864).

This is not part of the same collection as the type of *A. aneura* var. *stenocarpa*. It was collected 2 months after that type, and at least 50 km distant.

The confusion surrounding this name derives from the occurrence of two sympatric taxa which, while having quite distinctive pods, are, to date, indistinguishable vegetatively and florally.

These taxa are:

- A) flat-podded forms with transverse seeds; and
- B) forms with pods oval in section, and with longitudinal seeds.

Within these two taxa, a number of type specimens have been designated. These are: within taxon A) *Acacia aneura*; within taxon B) *A. aneura* var. *stenocarpa*; *A. cibaria* (as lectotypified by Pedley 1978).

In addition, the type of *A. brachystachya* Benth. agrees vegetatively with both taxa A and B. However, it is without pods, so that, at this point in time, it cannot confidently be placed within either of these taxa.

Thus at this stage, *A. brachystachya* Benth. must be considered *nomen dubium*. It is excluded from this treatment.

*Usage of the name "brachystachya"*

Bentham described the taxon in 1864. Mueller (in Tate 1882), having noted that *A. aneura* and *A. brachystachya* Benth. are sympatric, and that flowering specimens cannot be readily distinguished (because "the length of the spike is variable"), decided that it seemed advisable to "abolish the latter specific name". He described *A. cibaria* to include forms with pods either oval in section or quite cylindrical, while flat-podded forms were left in *A. aneura*.

However, Mueller soon became convinced that at least two species were involved in *A. cibaria* (in Tate 1882, and mss notes on specimens, MEL). Later, plants with cylindrical pods were separated as *A. ramulosa* W.Fitzg. But the name *A. cibaria* F. Muell. was used for plants with oval-section pods until about 1915, by workers such as Bailey (1900) and Maiden (1906).

Later (e.g. in 1917b) Maiden decided that *A. brachystachya* was of the oval-pod type, but without giving reasons for his assumption. [My emphasis]. He then discussed the identity of *A. cibaria* F. Muell., deciding that it was a mixture of *A. brachystachya* sensu Maiden and *A. ramulosa* W. Fitzg. Consequently Maiden decided that the name *cibaria* "had better be dropped" (1917b).

Thus Mueller and Maiden had reached conflicting decisions about the usage of the name *brachystachya*, and neither of them could be vindicated by reference to the type material.

Since 1917, most published workers have followed Maiden, so that *A. cibaria* F. Muell. has virtually disappeared, to be replaced by *A. brachystachya* sensu Maiden, a name previously used only by Benth. Maiden may have used the name consistently, but later workers have been less confident e.g. Maslin (1980) was not convinced of its distinction from *A. ramulosa* and Fox (1986) described it as having "flat thick phyllodes".

The consequences of this name change should be limited, as the species, though widespread, is relatively uncommon throughout its distribution. The name *A. brachystachya* sensu Maiden has been used consistently in New South Wales and Queensland, but here the distribution is restricted to far western areas. The taxon has a wider distribution in other states, but has not previously been studied in Western Australia, and the name was used with hesitation in South Australia.

Material without pods (i.e. not identifiable as either *A. aneura* or *A. cibaria*) may still be referred to *A. aneura* sens. lat.

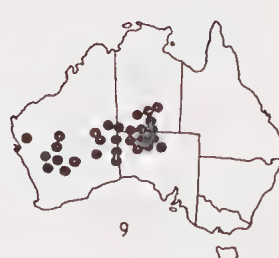
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Maps 1-10. 1, *A. ramulosa* W. Fitzg.; 2, *A. paraneura* Randell; 3, *A. cibaria* F. Muell.; 4-5, *A. aneura* F. Muell. ex Benth.; 4, var. *aneura*; 5, var. *macrocarpa* Randell.; 6, *A. aneura* F. Muell. ex Benth. var. *conifera* Randell; 7-8, *A. ayersiana* Maconochie; 7, var. *ayersiana*; 8, var. *latifolia* (J. Black) Randell; 9, *A. minyura* Randell; 10, *A. craspedocarpa* F. Muell.

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